Drought, Climate Change and Potential Agricultural Productivity

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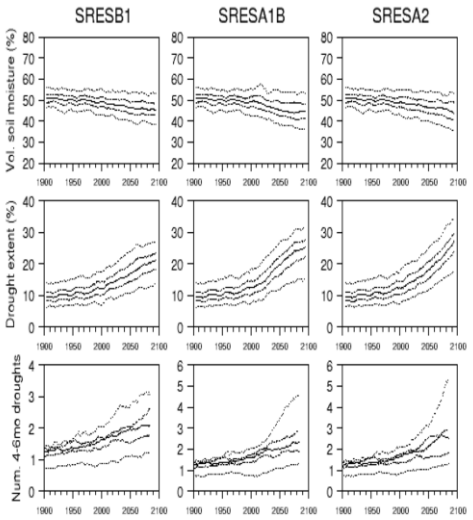


Drought, Climate Change and Agriculture

- **Drought is a major factor in agricultural productivity especially in developing regions**
- **Recent events in East Africa are testament to this**
- **Prospects for the future under climate change are of concern**

- **This is set against the expected increase in population, changing demographics and increases in non-food agriculture**

Key Findings

1. *How has drought varied over the 20th and early 21st centuries?*

   Not significantly, although there has been drying over the last 10 years

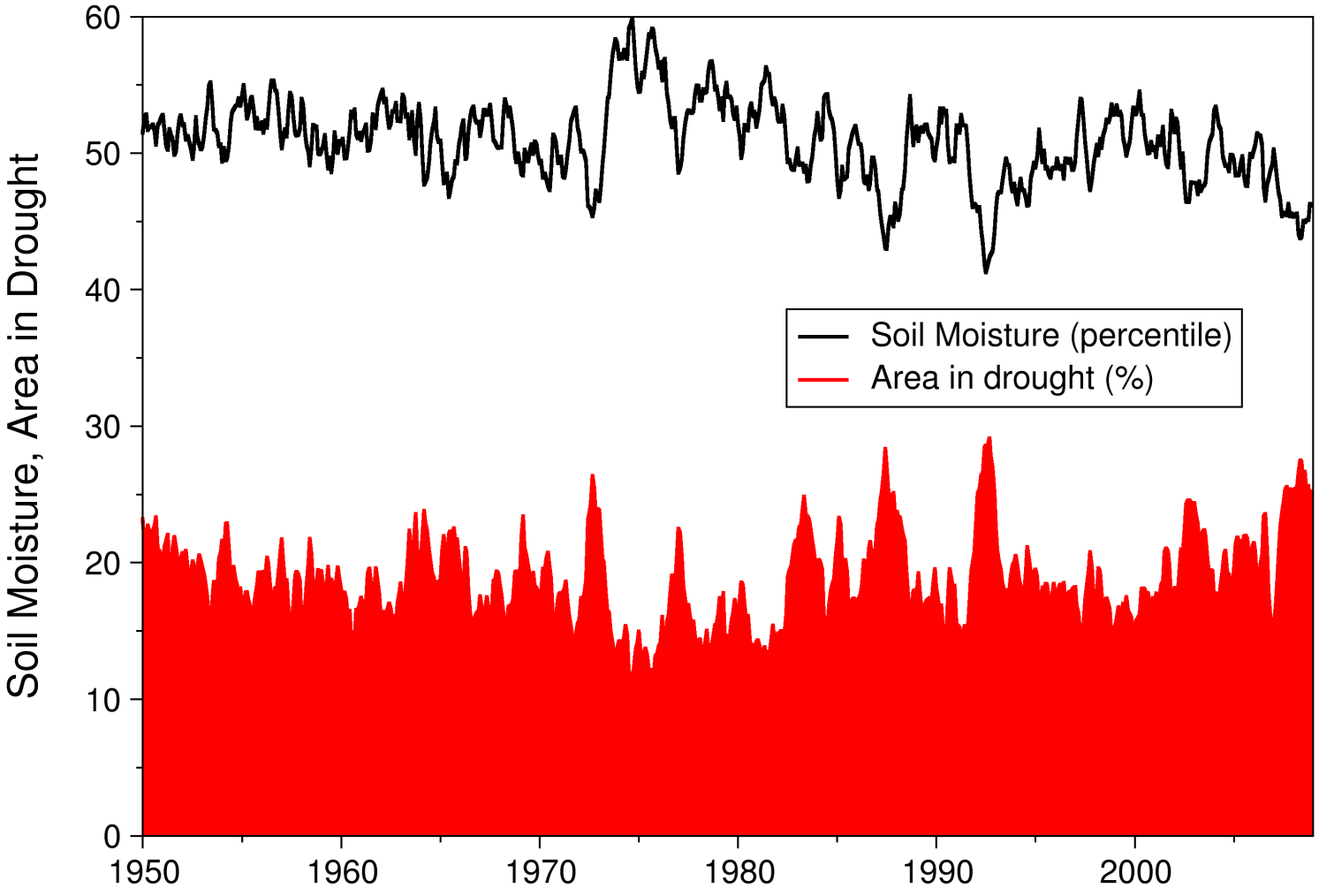
2. *What are the projected changes for the 21st century?*

   Twofold increase in drought frequency by mid 21st C, threefold by end of 21st C for many regions

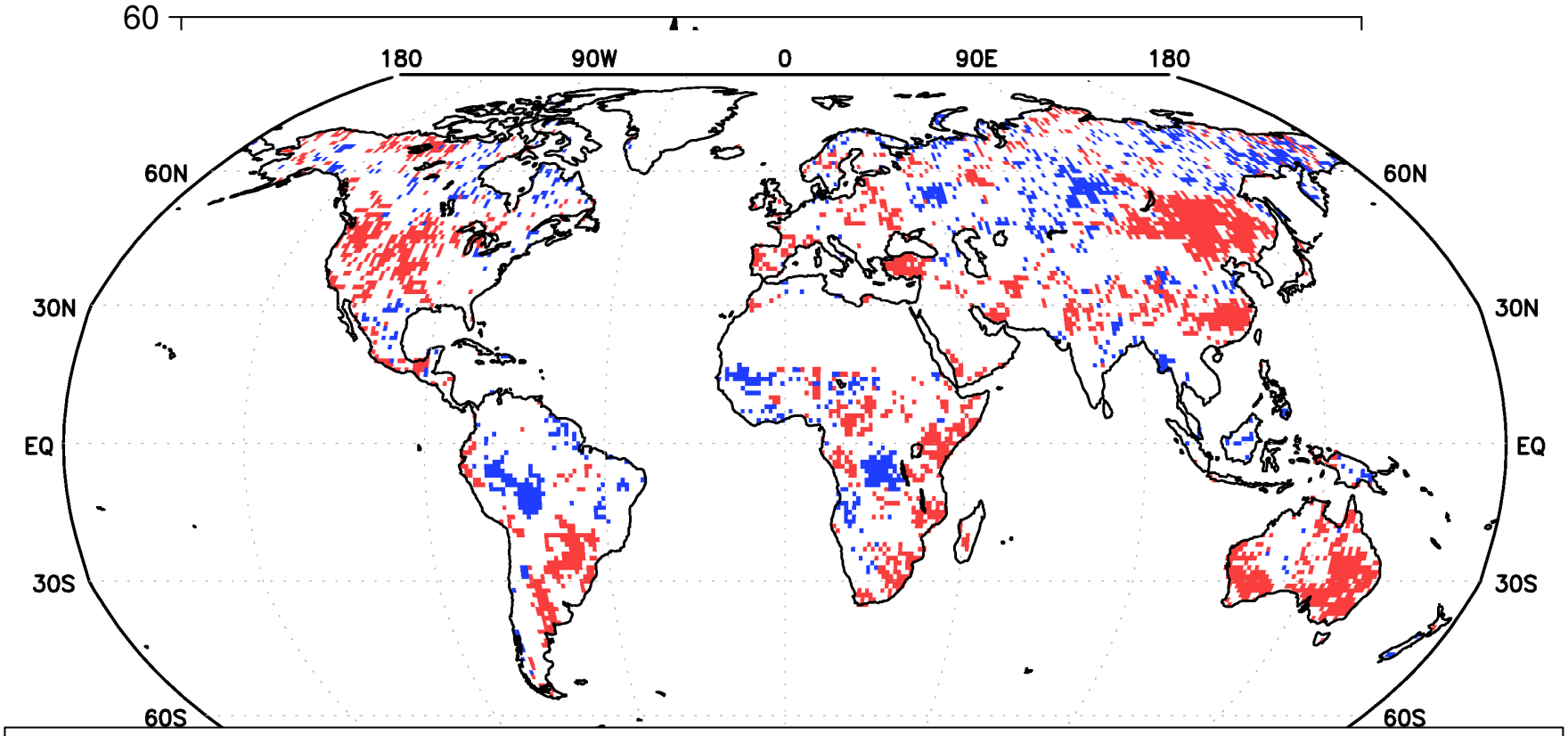
1. *How do these changes translate into changes in agricultural productivity?*

   General declines and increased variability

20thC and Early 21stC Trends in Drought



Evidence of Global Drying in Past Decade



Trends in Soil Moisture 1998-2008

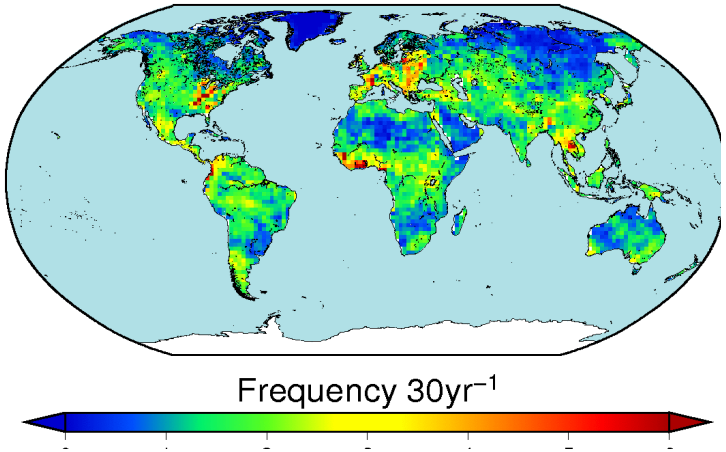
Significant Drying Trends, Significant Wetting Trends

Will this trend continue?

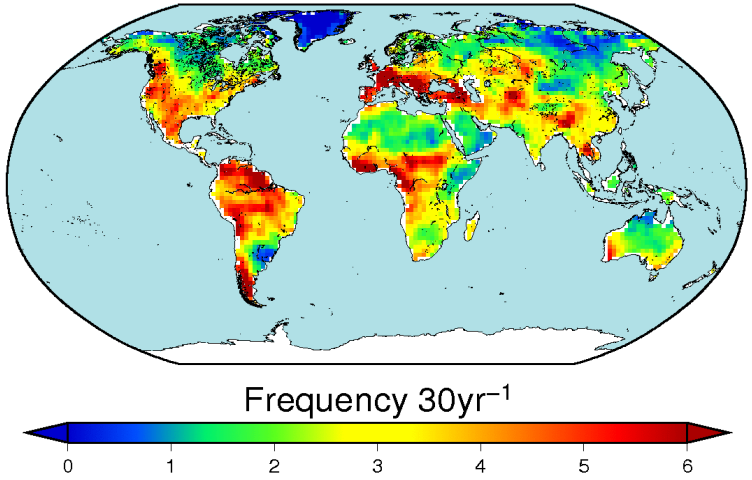
Future Climate Projections of Seasonal Drought Frequency

Current Climate

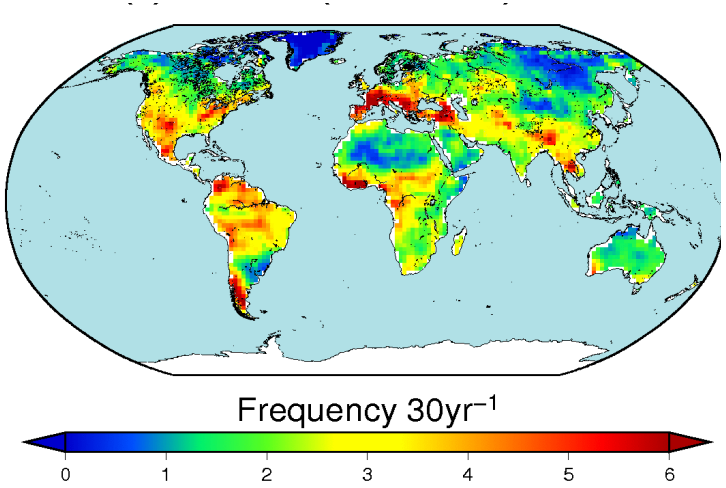
(a) 20C3M (1961–90) Mean



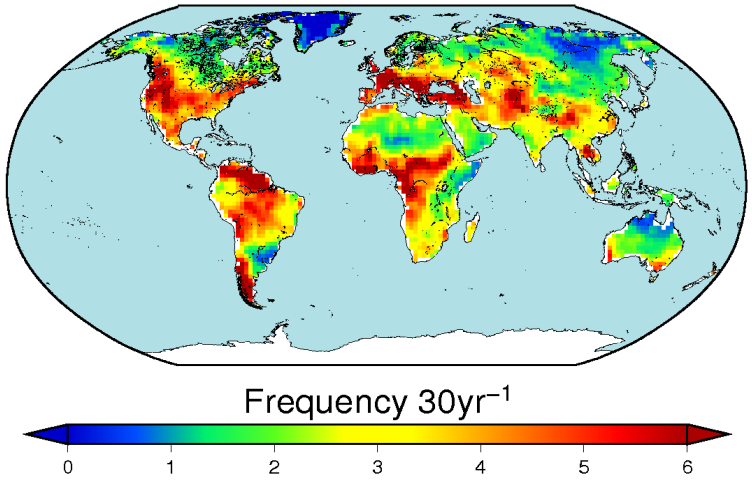
Medium Emission Scenario 2070-2099



Low Emission Scenario 2070-2099



High Emission Scenario 2070-2099



Data from AR4 / CMIP3 Climate Model SImulations

Examples of Historic and Future Drought Events

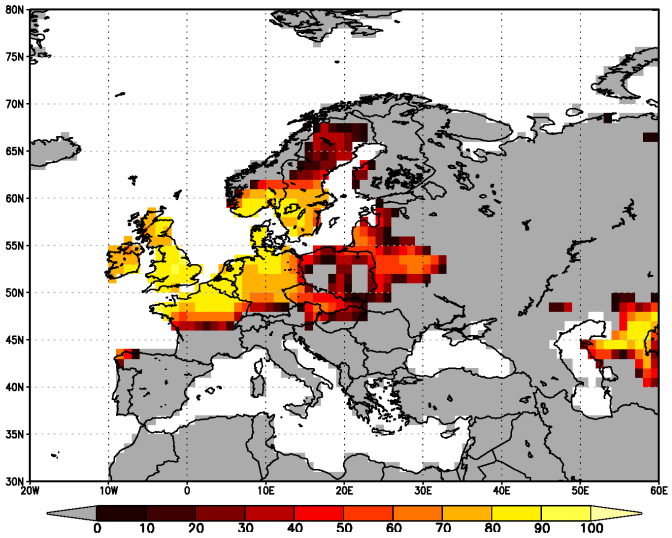
Historic Droughts

Potential Future Droughts

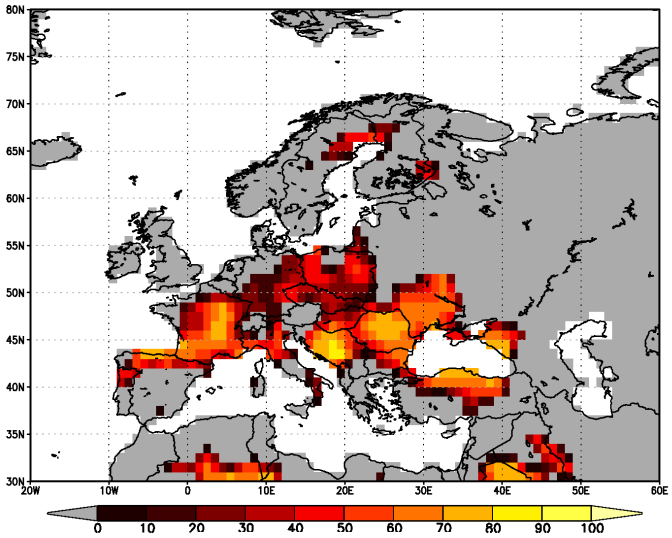
2 to 3 times more likely

More extensive

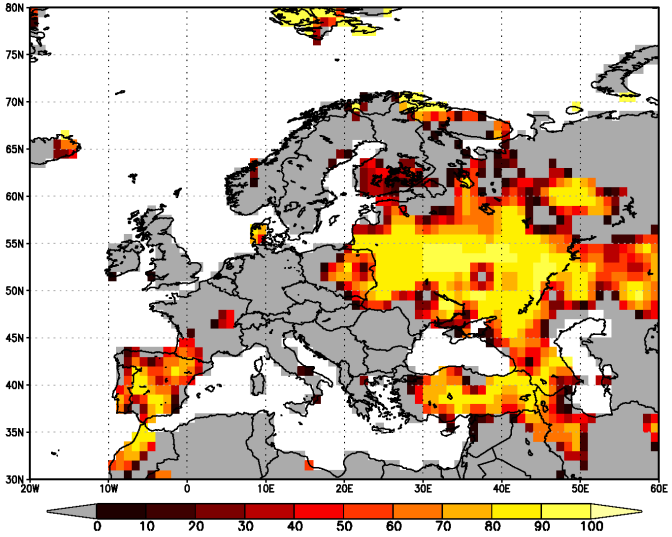
Northwest European Drought 1976



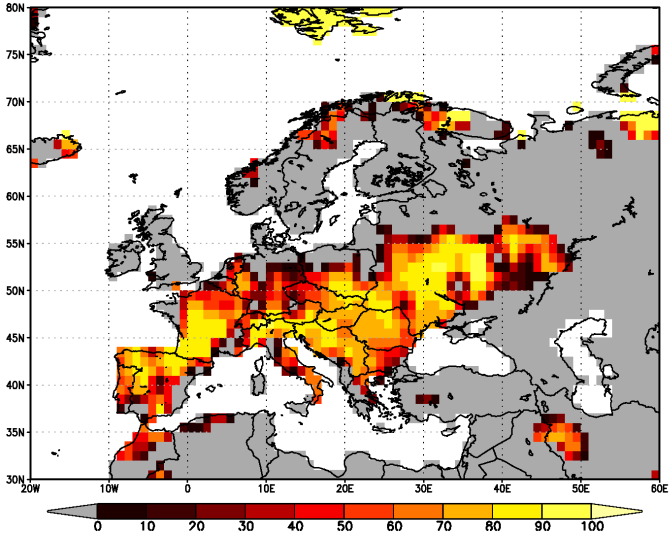
European Heatwave and Drought 2003



Summer 2052



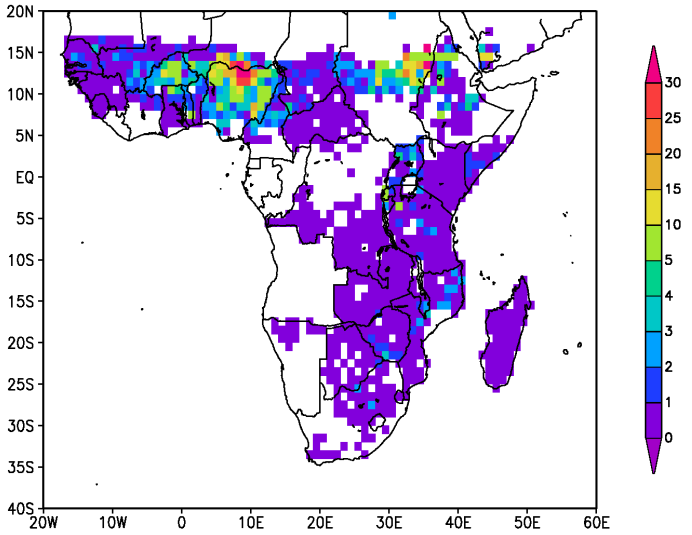
Summer 2096



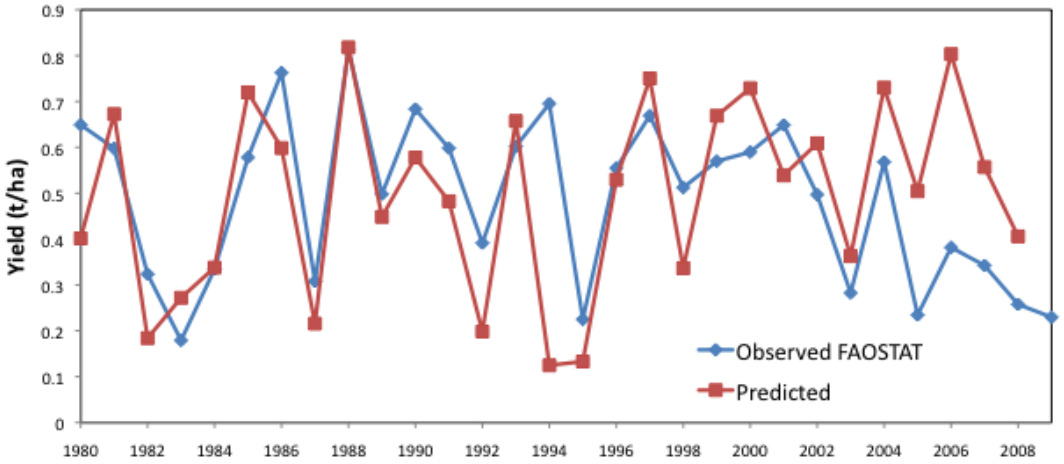
Climate Impacts on Agricultural Production

- How do climate variability and change translate into changes in production?
- We use a simple crop production model
- Examples shown for sorghum across Africa
- Crop production model does good job at replicating year to year variability in production

Sorghum Harvested Area (%)

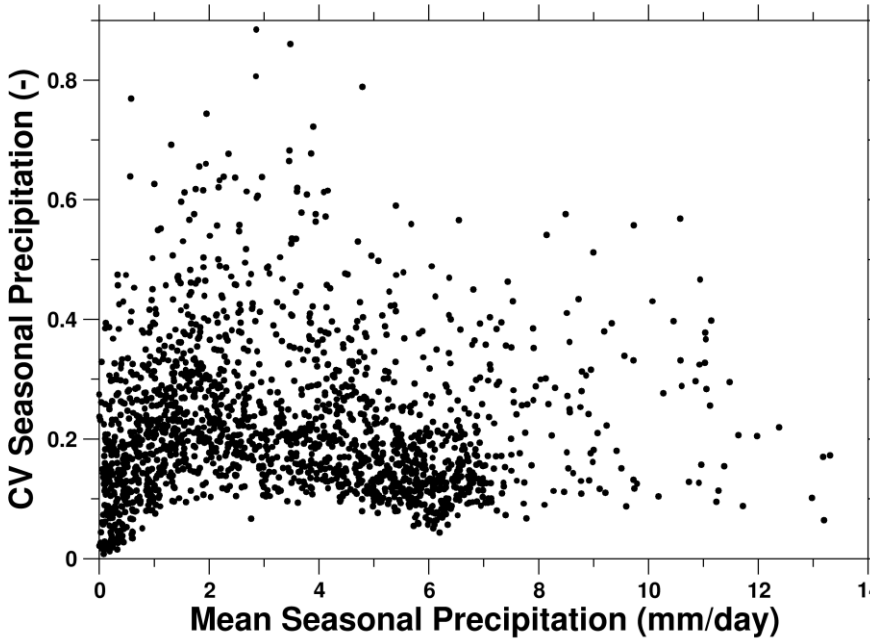


Evaluation of crop production predictive model: Example for sorghum in Zimbabwe



Climate Variability Impacts on Agricultural Production

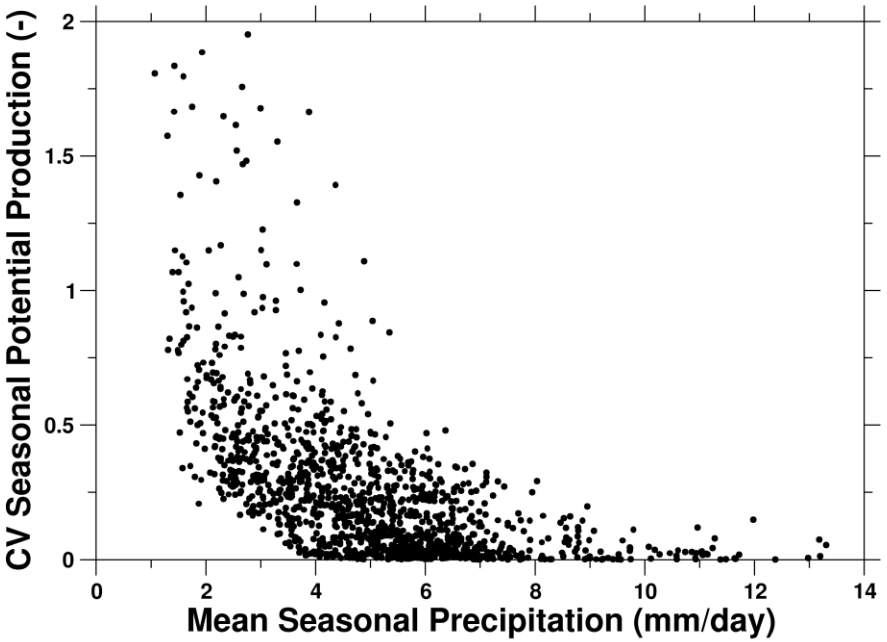
Seasonal precipitation is highly variable from year to year



More variability →

Wetter regions →

This translates into even higher variability in crop production from year to year

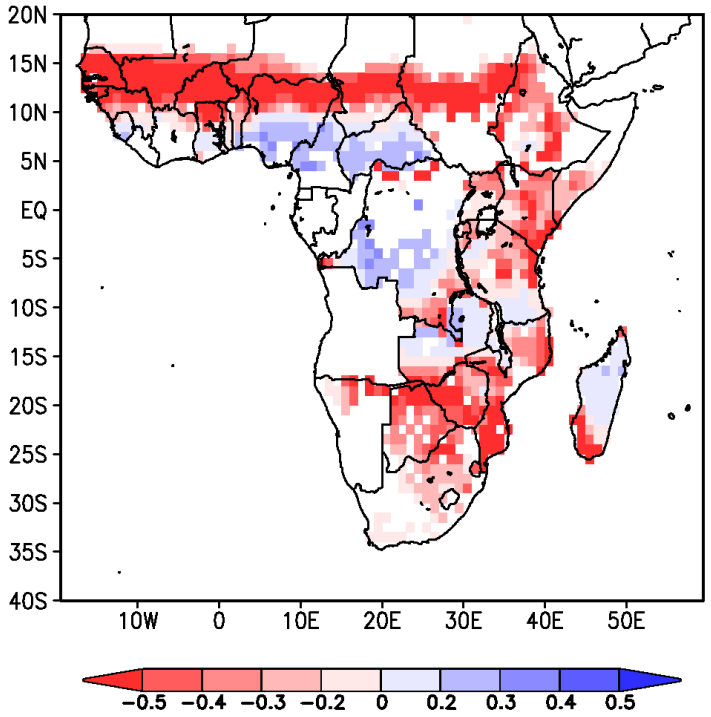


Wetter regions →

Future Climate Impacts on Agricultural Production

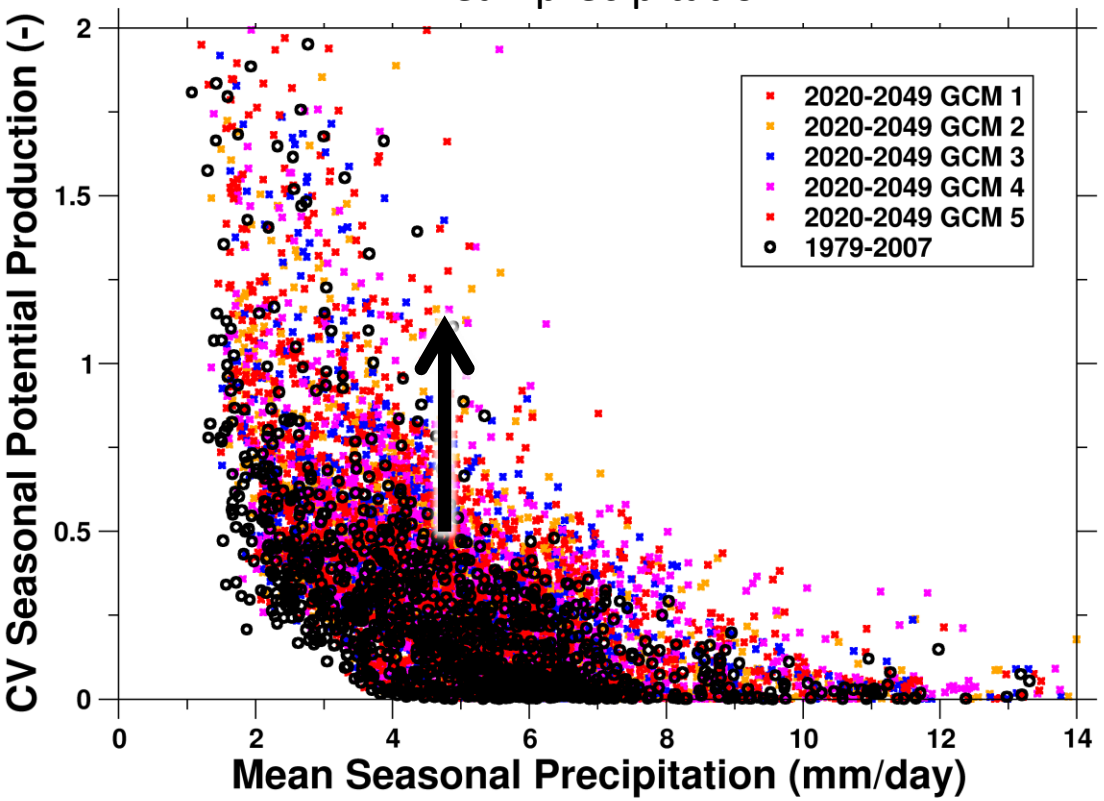
Based on 5 climate models (AR4/CMIP3-SRESA2) downscaled and bias corrected

Change in production between 1979-2007 and 2020-2049



General **decline** in production by mid 21st century. Modest **increase** in humid regions due to more seasonal precipitation

Crop production variability versus mean precipitation



Shift towards more variability in crop production by mid 21st century

Conclusions

- Globally, drought has not changed significantly over the past 60 years
- But extensive drying over the last decade hints at the impact of climate change
- Climate model projections indicate large increases in drought frequency, duration and extent
- Agricultural productivity is likely to suffer as a result, especially in transitional climate regions